NEW FORM SPECIES OF POLLEN FROM SOUTHERN AUSTRALIAN EARLY TERTIARY SEDIMENTS

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Summary

Sixteen new form species of dispersed pollen grains: *Sparganiaceaepollenites barungensis, Amosopollis dilwynensis, "Triorites" psilatus, Tricolporites valvatus, Triporopollenites gemmatus, Ericipites crassiexinus, Sapotaceoidaepollenites rotundus, Proteacidites confragosus, P. tripartitus, P. kopiensis, P. tortuosus, P. clintonensis, P. fromensis, P. varius, P. wilkatanaensis,* and *P. concretus* and one new form genus, *Gambierina,* are described from early Tertiary sediments from southern Australia.

Introduction

This paper describes several new species and a new genus, *Gambierina,* that were mentioned as manuscript names by Harris (1971) in an account of the palynology of Tertiary sediments in the Otway Basin. These forms were considered to have some biostratigraphic significance.

Previous taxonomic studies of Tertiary angiosperm pollen from Australia are limited to the works of Cookson (1947, 1950, 1953, 1954, 1957 & 1959), Cookson & Pike (1954) and Harris (1965a). Dettmann & Playford (1968) described four new angiosperm pollen species from Upper Cretaceous sediments from eastern Australia and some of these probably extend into the early Tertiary.

The preparation technique is that outlined by Harris (1965a) and the descriptive terminology is largely adapted from Erdtman's glossary (1952). Dimensions are based on fifteen or more specimens. Biostratigraphic data are based in part on unpublished studies by the author and on Harris (1971) and McGowran, Lindsay & Harris (1971). Sample data are presented in the appendix.

All co-ordinates are from the Leitz Orthoplan (715494) microscope in the Palynology Laboratory of the Geological Survey of South Australia and Holotypes (catalogue numbers prefixed Py) are deposited in the Geological Survey Palaeontological collection.

Systematic Palynology

Genus SPARGANIACEAEPOLLENITES Thiergart 1937

Type species: *Sparganiaceaepollenites polygonalis* Thiergart 1937: 307.

Sparganiaceaepollenites barungensis sp. nov.

FIGS. 1–3

Pollen monoporate, sphaeroidal to slightly bilateral. Pore circular (3–4 μm diam.) with incrassate margin 1–1.5 μm wide. Exine 2 μm thick, sexine as thick as nexine, reticulate. Reticulum undifferentiated over the grain, lumina 1–1.5 μm diam. *Dimensions:* Equatorial diam. 18 (22) 25 μm.

Holotype: Preparation and slide number—ST325/15, 42.1: 110.8. Py 195. Figs. 1, 2. *Type locality:* Hd. Barunga Bore 4 at 65.5 m. Clinton Formation, ?Lower Miocene. *Distribution:* This species first occurs in the Upper Eocene and continues through to the Upper Tertiary.

Comparison and affinity: The pollen figured by Couper (1960, pl. 9, figs. 21, 22) as *Typha* sp. appears to be very similar to *S. barungensis. S. barungensis* differs from *Aglaoreidia* Erdtman in not having a differentiated reticulum. *"Monoporites" subreticulata* Cookson has a wider rim to the pore. The species here described appeared under this generic name in Harris (1971) and McGowran, Lindsay & Harris (1971). *S. magnoides* Krutzsch (1970)

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approaches *S. barungensis* in size but has a wider meshed reticulum. *S. barungensis* is very similar to pollen of *Typha* and *Sparganium*.

Genus AMOSOPOLLIS Cookson & Balme 1962

Type species: *Amosopollis cruciformis* Cookson & Balme 1962: 97.

Amosopollis dilwynensis sp. nov.

FIGS. 4, 5

Synonymy: Amosopollis cruciformis sensu Harris 1965a: 97, Pl. 29, fig. 26.

Pollen grains in rhomboidal tetrads. Individual grains prolate to sub-prolate. Exine 2 μm thick, psilate to scabrate and finely granulate, except near the margins of the aperture where grana 1–1.5 μm diam. are present. Aperture is a long gaping sulcus extending the full length of the grain. Margins of sulcus not ragged. *Dimensions:* (10 specimens) Overall diam. of tetrad 50 (60) 68 μm. Individual grains 22 (34) 40 μm diam.

Holotype: Preparation and slide number—ST209/2, 39.3: 100.7. Py 015. Figs. 4, 5.

Type locality: Dilwyn Bay, Victoria, Pebble Point Formation, Paleocene.

Distribution: A. dilwynensis is a rare species but has been observed in Paleocene sediments from the Murray and Otway Basins, and a similar form has been reported (Harris 1965b) from Queensland in sediments of similar age.

Comparison and affinity: A. dilwynensis is in general larger than the genotype but can also be distinguished by the psilate-scabrate sculpture and more importantly by the straight margins of the sulcus.

Genus TRIORITES Cookson ex Couper 1953

Type species (by subsequent designation of Couper 1953, p. 60): *Triorites magnificus* Cookson 1950.

"Triorites" psilatus sp. nov.

FIGS. 6, 7

Pollen radiosymmetric, isopolar, oblate, triorate. Amb sub-triangular, sides straight to slightly convex. Ora sunken, 2–4 μm wide, circular. Exine 2μm except around apertures where it thickens to 3 or 4 μm. Exine psilate. *Dimensions:* Equatorial diam. 24 (32) 40 μm.

Holotype: Preparation and slide number—S564/1, 32.8: 100.6. Py 411. Fig. 6.

Type locality: Polda No. 1 Bore at 55.1 m. Poelpena Formation, Middle Eocene.

Distribution: This species is a very common form throughout the Lower Tertiary in southern Australia. It first appears in the Princetown Member and ranges through to the Lower Miocene. The upper limit has not been determined.

Comparison and affinity: "T" psilatus is comparable and may be conspecific with *"T." scabratus* Couper. The ornament on the latter however is scabrate. This species would more appropriately be placed in a new genus (see section on *Triorites* below).

Genus TRICOLPORITES Cookson 1947

Type species: *Tricolporites sphaerica* Cookson 1947: 195; genus monotypic when proposed.

Tricolporites valvatus sp. nov.

FIGS. 8, 9

Pollen radiosymmetric, prolate tricolporate. Amb in equatorial view ellipsoidal. Apertures compound, colpi reaching to within 3 or 4 μm of the poles, margins strongly invaginated to about 8 μm. Equatorial aperture orate, 5–8 μm diam. Exine 2–3 μm thick unornamented. *Dimensions:* Polar diam. 45 (52) 55 μm, equatorial diam. 30 (35) 39μm.

Holotype: Preparation and slide number—ST241/12, 35.1: 98.1. Py 176. Fig. 9.

Type locality: Lake Torrens Bore 3A at 247.8 m. "Wilkatana Formation", Middle Eocene.

Distribution: Common in the "Wilkatana Formation" but less common in other Middle Eocene (*Proteacidites confragosus* Zonule) assemblages.

Comparison and affinity: The strongly invaginated colpi and psilate exine make this a very distinctive species. Its natural affinities are unknown.

Genus ERICIPITES Wodehouse 1933

Type species: *Ericipites longisulcatus* Wodehouse 1933: 517.

Ericipites crassiexinus sp. nov.

FIGS. 15, 16

Pollen united in tetrads. Individual grains indistinctly tricolporate, tetrahedral in shape and strongly united in the tetrad. Exine 2.5–3.5 μm thick, sexine as thick as nexine psilate. Apertures complex, colpi about 14 μm long and 1.5 μm wide. Pores indistinct and difficult to detect, 2 μm diam. *Dimensions:* Overall diam. 35 (42) 53 μm. Individual grains 24 (30) 35 μm diam.

Holotype: Preparation and slide number—S660/1, 52.9: 96.9. Py 415. Fig. 15.

Type locality: Bore, Hd, Cummins at 35.7–43.3 m. Wanilla Formation, Middle Eocene.

Distribution: Often a very common form in middle and upper Eocene sediments.

Comparison and affinity: The psilate nature of the exine and the larger size of this species distinguishes it from *E. scabratus* Harris. Pollen of this type characterise the Order Ericales.

Genus TRIPOROPOLLENITES (Pflug) Thomson & Pflug 1953

Type species: *Triporopollenites coryloides* Pflug in Thoms. & Pfl. 1953: 84.

Triporopollenites gemmatus sp. nov.

FIGS. 10, 11, 13, 14

Pollen occasionally free but most commonly united in tetrads. Tetrads 34–40 μm in overall diam. Individual pollen radiosymmetric, oblate, sub-isopolar, triorate. Amb sub-triangular with straight to convex sides. Exine 4–5 μm thick (including ornament). Sexine and nexine difficult to separate but nexine appears to be thicker than sexine. Exine covered with verrucae 2–3 μm wide, sphaerical and 2 μm high. Verrucae separated from each other (by 2–3 μm) by granulate ornament. Apertures obscured by ornament, porate or orate opening 1.5–2.5 μm wide. *Dimensions:* Individual pollen, equatorial diam. 25 (29) 31 μm.

Holotype: Preparation and slide number—S547/1, 31.7: 98.4. Py 720. Fig. 11.

Type locality: Lake Cootabarlow Bore 2 at 163.4 m. Great Artesian Basin. Murnpeowie Formation, Upper Eocene.

Distribution: Appears to be restricted to Middle and middle-upper Eocene sediments from the Pirie-Torrens and Great Artesian Basins and Eyre Peninsula.

Comparison and affinity: *T. gemmatus* is similar to *T. bullis* Gruas-Cavagnetto (1966) from the Sparnacian of the Paris Basin but this species is more or less circular and appears to have a more strongly thickened rim to the aperture.

Genus GAMBIERINA gen. nov.

Type species: *Triorites edwardsii* Cookson & Pike (in part) 1954: 214, pl. 2, figs. 101, 105, 106.

Diagnosis: Pollen radiosymmetric, oblate, lobate, angulaperturate, triorate. Apertures sunken. Sexine imperforate tectate, thinner than nexine, the two separated by a faintly discernable baculate layer, which forms a "nick" point in the apertural region. Aperture formed by sexine larger than that of the nexine. Nexine thickens more rapidly than sexine about the apertures. Exine psilate.

Figured specimen: Fig. 12.

Remarks: The characters of the exine, the apertures and general shape distinguish this genus from *Triorites*. As Dettmann & Playford (1968, p. 86) have pointed out, the species figured by Cookson & Pike (1954, particularly figs. 104 and 105) as *T. edwardsii* is distinct in being unthickened about the apertures.

Dettmann & Playford (1968) summarised the present status of the genus *Triorites* but chose to continue using the diagnosis of Couper (1953) pending a review by the present author.

Potonié (1960) clearly indicated that the two species *T. magnificus* Cookson and *T. clavatus* Cookson were morphologically comparable and distinct from other forms allocated to the genus. However, Potonié gave no indication as to where these other forms should be placed.

It is clear that *T. magnificus* and *T. clavatus* are very closely related morphologically and perhaps phylogenetically. Indeed Cookson (1957, p. 49) goes so far as to state that "there is little or no doubt that they were produced by closely related plants. Both species have the same shape, type of ora and exine stratification, and structure. . . ." Thus these two species form a natural grouping and all other species assigned to the genus are better accomodated elsewhere. Couper's (1953) diagnosis is too broad and suggestive of a suprageneric category. Mildenhall & Harris (1971) have reached similar conclusions.

Genus SAPOTACEOIDAEPOLLENITES Pot., Thoms., & Thierg. 1950

Type species: *Sapotaceoidaepollenites* (al. *Pollenites*) *manifestus* (Potonié) 1931: 3.

Sapotaceoidaepollenites rotundus sp. nov.

FIGS. 17, 18

Pollen radiosymmetric, subsphaeroidal to sub-prolate, four and less frequently three apertures. Apertures compound. Colpi 2/3 length of polar axis, 2–3 μm wide. Equatorial aperture more or less circular, 5–6 μm diam. and slightly elongate in an equatorial direction. Apertural margin prominently rimmed and thickened. Exine 2–2.5 μm thick, nexine about as thick as sexine. Sexine psilate to finely scabrate. *Dimensions:* Polar diam. 30 (36) 39 μm, equatorial diam. 28 (33) 35 μm.

Holotype: Preparation and slide number—ST241/3, 45.7: 102.8. Py 167. Fig. 17.

Type locality: Lake Torrens Bore 3A at 247.8 m. "Wilkatana Formation", Middle Eocene.

Distribution: The species first appears in the Middle Eocene and continues on into the mid-Tertiary.

Comparison and affinity: The closest resemblance of this species is with *Tricolporopollenites latizonatus* McIntyre 1968, which is most commonly 3-aperturate, has a longer polar/equatorial axis ratio and has a broad thickened zone of the exine in the equatorial region. The species is very similar to pollen of the Sapotaceae.

Genus PROTEACIDITES Cookson ex Couper 1953

Type species: *Proteacidites adenanthoides* Cookson 1950: 172, designated by Couper 1953: 42.

Remarks. The genus *Proteacidites* accomodates at present a wide variety of forms described from both the Southern and Northern Hemispheres. Some from the latter clearly do not belong in this genus but until a review of the Australian forms by the author is complete (and on present evidence the genus will be split into three or more genera) comment on these is reserved. Although the following new species show a wide variation in form with regard to aperture construction and exine stratification and ornamentation they will be described under this genus but will be further reviewed in a forthcoming paper.

Proteacidites confragosus sp. nov.

FIGS. 19–22

Pollen sub-isopolar, angulaperturate, oblate, triporate. Amb triangular with slightly convex sides. Pores simple subcircular 6–7 μm diam., obscure. Exine 4–5 μm thick. Sexine three times as thick as nexine, heavily ornamented with a dense reticulum, lumina 3–4 μm diam., polygonal and made up of single rows of distinct bacula 1–1.5 μm diam. *Dimensions:* Equatorial diam. 54 (60) 69 μm.

Holotype: Preparation and slide number—ST241/9, 41.4: 105.7. Py 173. Figs. 19, 21, 22.

Type locality: Lake Torrens Bore 3A at 247.8 m. "Wilkatana Formation", Middle Eocene.

Distribution: An index form for Middle Eocene sediments, *P. confragosus* has been recorded from the North Maslin Sands, the Renmark, Poelpena and Wanilla Formations and the Burrungule Member of the Knight Formation.

Comparison and affinity: This is a striking species and is clearly distinct from any other known in the genus.

Proteacidites tripartitus sp. nov.

FIGS. 23–25

Pollen sub-isopolar, oblate, angulaperturate, triporate. Amb triangular with more or less straight sides. Apertures sub-circular, simple but obscure 2–2.5 μm wide. Exine 2.5–3 μm thick. Sexine half as thick as nexine, foveolate. Lumina *ca.* 1 μm diam., slightly smaller at the poles and towards the apertures. Muri 2–3 μm wide. Nexine thickens to 5 μm at 10 μm from the apertures. Pore "canal" 7–8 μm long. *Dimensions:* Equatorial diam. 27 (30) 34 μm.

Holotype: Preparation and slide number—S650/1, 32.2: 99.8. Py 406. Figs. 24, 25.

Type locality: Hd. Cummins Bore at 114–116.4 m. Wanilla Formation, Middle Eocene.

Distribution: The species first appears very high in the Princetown Member of the Dilwyn Formation but does not become common until the Middle Eocene.

Comparison and affinity: The detail of the apertures closely resembles that found in *P. latrobensis* Harris and *P. concretus* but is distinguished by the characteristic ornament.

Proteacidites kopiensis sp. nov.

FIGS. 26, 27

Pollen sub-isopolar, oblate, angulaperturate, triporate. Amb triangular, sides straight or nearly so. Apertures subcircular, simple, 7–8 μm diam. Exine 2μm thick and slightly thicker in the equatorial inter-aperturate regions. Sexine about half as thick as nexine, ornamented with a reticulum. Muri 1–1.5 μm wide. Lumina 2–3 μm diam. at the equator and decreasing gradually to 1 μm towards the apertures and polar regions. *Dimensions:* Equatorial diam. 36 (40) 47 μm.

Holotype: Preparation and slide number—S560/1, 26.1: 106.9. Py 393. Fig. 26.

Type locality: Polda No. 1 Bore at 37.5 m. Poelpena Formation, Middle Eocene.

Distribution: The species is present in the uppermost section of the Princetown Member of the Dilwyn Formation and continues in all basins into the middle-upper Eocene. It does not appear to range higher than the *Triorites magnificus* Zonule.

Comparison and affinity: This species is readily distinguished from other *Proteacidites* spp. by the characteristic ornament pattern.

Proteacidites tortuosus sp. nov.

FIGS. 28, 29

Pollen sub-isopolar, oblate, angulaperturate, triporate. Amb rounded triangular, sides convex. Pores simple 13–15 μm wide. Exine 5 μm thick. Nexine thicker than sexine. Sexine ornamented with scattered verrucae, 2 μm wide and up to 6 μm long, rounded in optical section and 2 μm high. Areas between these elements psilate. *Dimensions:* Equatorial diam. 53 (55) 58 μm.

Holotype: Preparation and slide number—S563/2, 32.2: 99.8. Py 409. Figs. 28, 29.

Type locality: Polda No. 1 Bore at 55.1 m. Poelpena Formation, Middle Eocene.

Distribution: This species has been recorded from Middle Eocene sediments on Eyre Peninsula, Poelpena and Wanilla Formations.

Comparison and affinity: The large distinctive verrucae, thick exine and rounded sub-triangular shape separate this species from other species described here. *P. tortuosus* differs from *P. tuberculatus* Cookson in being smaller. The verrucae are not arranged in a reticuloid pattern and are not confined to a spherical shape.

Proteacidites clintonensis sp. nov.

FIGS. 30-34

Pollen sub-isopolar, oblate angulaperturate, triporate. Amb more or less triangular with concave sides. Pores circular 20–35 μm in diam. Exine 3 μm thick, sexine slightly thinner than nexine. Capita of bacula coalesce to form groups up to 7μm wide and show an LO pattern. Elements rounded in optical section. Nexine in region of pores, alternately thick and thin. The sexine is readily lost by corrosion. *Dimensions:* Equatorial diam. 62 (75) 98 μm.

Holotype: Preparation and slide number—S705/1, 31.3: 105.2. Py 405. Figs. 32–34. *Type locality:* Poyntz Bore, Hd. Ettrick at 94.5 m. Renmark Beds, middle-upper Eocene.

Distribution: The species is almost ubiquitous in Eocene sediments and is particularly common in the *Triorites magnificus* Zonule. It ranges from Middle Eocene to at least Lower Miocene.

Comparison and affinity: This species is similar to *P. rectomarginus* Cookson but has much larger apertures and strongly concave sides. Figure 30 more closely resembles *P. rectomarginus* with its finer ornament, larger size and straighter sides. It is possible that the two forms intergrade. Cookson's figure (1950, fig. 27) of *P. rectomarginus* appears to show some thickening of the nexine about the apertures. The species is distinguished from *P. incurvatus* by the nature of the sculpture and the characteristic aperture. The exine does not thin markedly near the apertures as it does in *P. incurvatus.*

Proteacidites fromensis sp. nov.

FIGS. 35–38

Pollen sub-isopolar, oblate, angulaperturate, triporate. Amb triangular, sides strongly concave. Pores simple, circular, 5 μm in diam. Exine 2.5–3 μm thick. Sexine slightly thinner than nexine in the inter-angles and thins towards the angles, evenly granulate to scabrate. Nexine thickest in the inter-angles. *Dimensions:* Equatorial diam. 61 (65) 70 μm.

Holotype: Preparation and slide number—S17/2, 35.1: 101.4. Py 408. Figs. 35–37. *Type locality:* Lake Eyre Bore 20 at 73.2 m. Murnpeowie Formation, Paleocene.

Distribution: P. fromensis is restricted to and characteristic of Palaeocene sediments and is most common in the Murray and Great Artesian Basins.

Comparison and affinity: The strongly concave sides of the amb, size, and the scabrate ornament separate this species from others in the genus. It differs from *P. granoratus* Couper in that the ornament does not become coarser around the apertural region.

Proteacidites varius sp. nov.

FIGS. 39–42

Pollen small, sub-isopolar, peroblate, angulaperturate. Amb triangular with straight or slightly concave sides. Apertural pores, three, 2.5 μm diam. Exine 2–2.5 μm thick. Sexine much thinner than nexine and thins markedly near the apertures. Nexine thins toward the apertures with loss of ?endonexine elements near the aperture. Ornament 0.5 μm high, consisting of fused groups of bacula *ca.* 1 μm diam. Groups becoming smaller to absent near apertures. *Dimensions:* Equatorial diam. 20 (25) 37 μm.

Holotype: Preparation and slide number—S705/1, 37.2: 111.0. Py 399. Figs. 39, 40.

Type locality: Poyntz Bore, Hd. Ettrick at 94.5 m. Renmark Beds, Upper Eocene.

Distribution: A common species in middle and upper Eocene assemblages in the Murnpeowie and Poelpena Formations in particular.

Comparison and affinity: The nature of the ornament distinguishes the species from *P. reticulatus* Cookson and *P. symphyonemoides* Cookson. The characteristic nexine structure (see particularly Fig. 41) is distinctive. The relationship of this species to *P. obscurus* Cookson is not clear. Her figured specimens (Cookson 1952, figs. 30, 31) have lost most of the sexine. The species described here shows thinning of the exine about the apertures rather than slight thickening and is not "lancet-shaped" as described for *P. obscurus.*

Proteacidites wilkatanaensis sp. nov.

FIGS. 43–47

Pollen sub-isopolar, oblate, angulaperturate, triporate. Amb triangular with straight to concave sides slightly bulging about 10 μm from apertures. Apertures circular 4–6 μm diam. Exine 4 μm thick, thinning rapidly near the apertures. Nexine about 3 times as thick as sexine, thinning and apparently losing the basal layer near the apertures. Sexine consists of a thin baculate layer and an ectosexinous layer formed of united baculate elements giving a low rugulate ornament. Rugulae 1–3 μm long, less than 1 μm wide. *Dimensions:* Equatorial diam. 51 (55) 61 μm.

Holotype. Preparation and slide number—S2273/4, 44.1: 106.7. Py 720. Figs. 43, 44.

Type locality: Bore near Ediacara at 280.4–283.5 m. "Wilkatana" Formation, middle-upper Eocene.

Distribution: The species is commonly observed in middle-upper Eocene sediments in most basins.

Comparison and affinity: The species differs from *P. incurvatus* Cookson and *P. clintonensis* in not being puncti-tegillate. The ornament is similar to that of *P. varius* but the species is much larger and does not show the characteristic structure of the nexine around the apertures.

Proteacidites concretus sp. nov.

FIGS. 48, 49

Pollen sub-isopolar, oblate, angulaperturate, triporate. Amb triangular with straight sides. Apertures circular 1.5 μm diam. Exine 2 μm thick but thickens in the region of the aperture to 4 μm and forms a pore "canal" 5 μm long. Exine faintly and evenly scabrate to finely spinulate. LO pattern distinct. *Dimensions:* Equatorial diam. 25 (28) 32 μm.

Holotype: Preparation and slide number—S360/2, 35.8: 105.5. Py 404. Fig. 48.

Type locality: Kopi Anomaly KR9 at 61 m. Poelpena Formation, Middle Eocene.

Distribution: A common species in most Eocene sediments.

Comparison and affinity: This species is most closely similar to *P. latrobensis* Harris, particularly in the nature of the aperture. It differs, however, from this species by the nature of the ornament. (*P. latrobensis* has a scrobiculate pattern.)

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APPENDIX

SAMPLE DATA

Bore name (or outcrop)	Depth in metres (feet in parenthesis)	Formation	Basin	Locality	Type of Sample	Sample No.
Nullabor No. 6	105-122 (344-400)	Pidinga	Eucla	Lat. 31°09'00"S Long. 131°12'30"E	Percussion sludge	S623
Polda No. 1	37.5 (123)	Poelpena	Polda	Lat. 33°33'00"S Long. 135°20'00"E	Core	S560
Polda No. 1	51.8 (170)	Poelpena	Polda	Lat. 33°33'00"S Long. 135°20'00"E	Core	S562
Polda No. 1	55.1 (181)	Poelpena	Polda	Lat. 33°33'00"S Long. 135°20'00"E	Core	S563
Polda No. 1	57.9 (190)	Poelpena	Polda	Lat. 33°33'00"S Long. 135°20'00"E	Core	S564
Kopi Anomaly K.R.9	61 (200)	Poelpena	Unnamed	Lat. 33°24'10"S Long. 135°44'45"E	Core	S360
Hd. Cummins (W.Con.Res. adj. Sec. 16)	35.7-43.3 (117-142)	Wanilla	Cummins	Lat. 34°15'10"S Long. 135°40'45"E	Percussion sludge	S660
Hd. Cummins (W.Con.Res. adj. Sec. 16)	114-116.4 (374-382)	Wanilla	Cummins	Lat. 34°15'10"S Long. 135°40'45"E	Percussion sludge	S650
Cummins school residence	32-39 (115-128)	Wanilla	Cummins	Lat. 34°15'50"S Long. 135°43'20"E	Percussion sludge	S741
Lake Torrens Bore 3A	247.8 (813)	"Wilkatana"	Pirie-Torrens	Lat. 31°14'00"S Long. 138°01'45"E	Core	S241
Near Ediacara	280.4-283.5 (920-930)	"Wilkatana"	Pirie-Torrens	Lat. 30°48'34"S Long. 138°07'30"E	Cuttings	S2273
Hd. Barunga Bore 4	65.5 (215)	Clinton	St. Vincent	Lat. 33°45'55"S Long. 138°13'35"E	Core	S325
Lake Cootabarlow Bore 2	163.4 (536)	Murneowie	Great Artesian	Lat. 30°16'30"S Long. 140°08'30"E	Core	S547
E. A. Rudd Bore 5	116.1 (381)	Murneowie	Great Artesian	Lat. 31°13'00"S Long. 139°52'50"E	Core	S1986
Lake Eyre Bore 20	73.2 (240)	Murneowie	Great Artesian	Lat. 28°48'00"S Long. 137°30'20"E	Core	S17
Poyntz Bore, Hd. Ettrick	94.5 (310)	Renmark Beds	Murray	Lat. 35°00'30"S Long. 139°31'45"E	Percussion sludge	S705
S.E. side of Dilwyn Bay	1.8 m above base of formation	Pebble Point	Otway	Lat. 38°44'00"S Long. 143°10'30"E	Outcrop	S208
S.E. side of Dilwyn Bay	1.2 m above base of formation	Pebble Point	Otway	Lat. 38°44'00"S Long. 143°10'30"E	Outcrop	S209

Note: Unless otherwise specified the figures are X500 in normal transmitted light. NDIC refers to Nomarski Differential Interference Contrast.

Figs. 1–12

Figs. 1–3. *Sparganiaceaepollenites barungensis* sp. nov., X 1250. Figs. 1, 2.—ST 325/15, 42.4: 110.3. Fig. 1.—High focus. Fig. 2.—Mid focus. Fig. 3.—S 325/3, 39.7: 96.8. Pore in N.W. quadrant.

Figs. 4, 5. *Amosopollis dilwynensis* sp. nov. Py 015, 38.7: 100.1. Fig. 5, X 1250. Notice the granulate margin of the sulcus.

Figs. 6, 7. *"Triorites" psilatus* sp. nov. X 1250. Fig. 6.—S564/1, 32.8: 100.6. Fig. 7.—S562/1, 37.7: 104.9.

Figs. 8, 9. *Tricolporites valvatus* sp. nov. Fig. 8.—ST 241/12, 39.0: 98.2. Fig. 9.—Py 176, 35.1: 98.1, X 1250, NDIC.

Figs. 10, 11. *Triporopollenites gemmatus* sp. nov. Fig. 10.—S650/1, 43.4: 104.5, single grain. Fig. 11.—S547/1, 31.7: 98.4, tetrad.

Fig. 12. *Gambierina edwardsii* (Cookson & Pike) Harris comb. nov. ST 208/2, 32.1: 103.7.

Figs. 13–25

Figs. 13, 14. *T. gemmatus* sp. nov. Fig. 13.—S547/1, 31.7: 98.4, X 1250 high focus. Fig. 14.—S741/2, 38.6: 106.8.

Figs. 15, 16. *Ericipites crassiexinus* sp. nov. Fig. 15.—S660/1, 52.9: 96.9. Fig. 16.—S560/1, 19.2: 107.2.

Figs. 17, 18. *Sapotaceoidaepollenites rotundus* sp. nov. Fig. 17.—Py 167, 45.7: 102.8, X 1250, NDIC. Fig. 18.—S564/1, 29.5: 106.4.

Figs. 19–22. *Proteacidites confragosus* sp. nov. Figs. 19, 21, 22.—ST 241/9, 41.4: 105.7. Fig. 21, 22, X 1250. Fig. 9 focused on ornament, fig. 10 focused on apertural region. Fig. 20.—ST 241/4, 35.6: 104.7.

Figs. 23–25. *Proteacidites tripartitus* sp. nov. X 1250. Fig. 23.—S560/1, 27.7: 100.8, NDIC. Figs. 24, 25.—S650/1, 32.2: 99.8, sectional and high focus respectively.

Figs. 26–37

Figs. 26, 27. *Proteacidites kopiensis* sp. nov. Fig. 26.—S560/1, 26.1: 106.9, X 1250, NDIC. Fig. 27.—S623/1, 16.6: 109.3, NDIC.

Figs. 28, 29. *Proteacidites tortuosus* sp. nov. S563/2, 32.2: 99.8. Median and high focus respectively.

Figs. 30-34. *Proteacidites clintonensis* sp. nov. Figs. 30, 31.—S741/2, 47.8: 96.3. Fig. 31, X 1250, high focus on polar region. Figs. 32–34.—S705/1, 31.3: 105.2. Fig. 33, X 1250, high focus on polar region; fig. 34, focus on apertural region.

Figs. 35–37. *Proteacidites fromensis* sp. nov. S17/2, 35.1: 101.4. Figs. 36, 37, X 1250. Fig. 36, high focus on polar region; fig. 37, median focus on interapertural region.

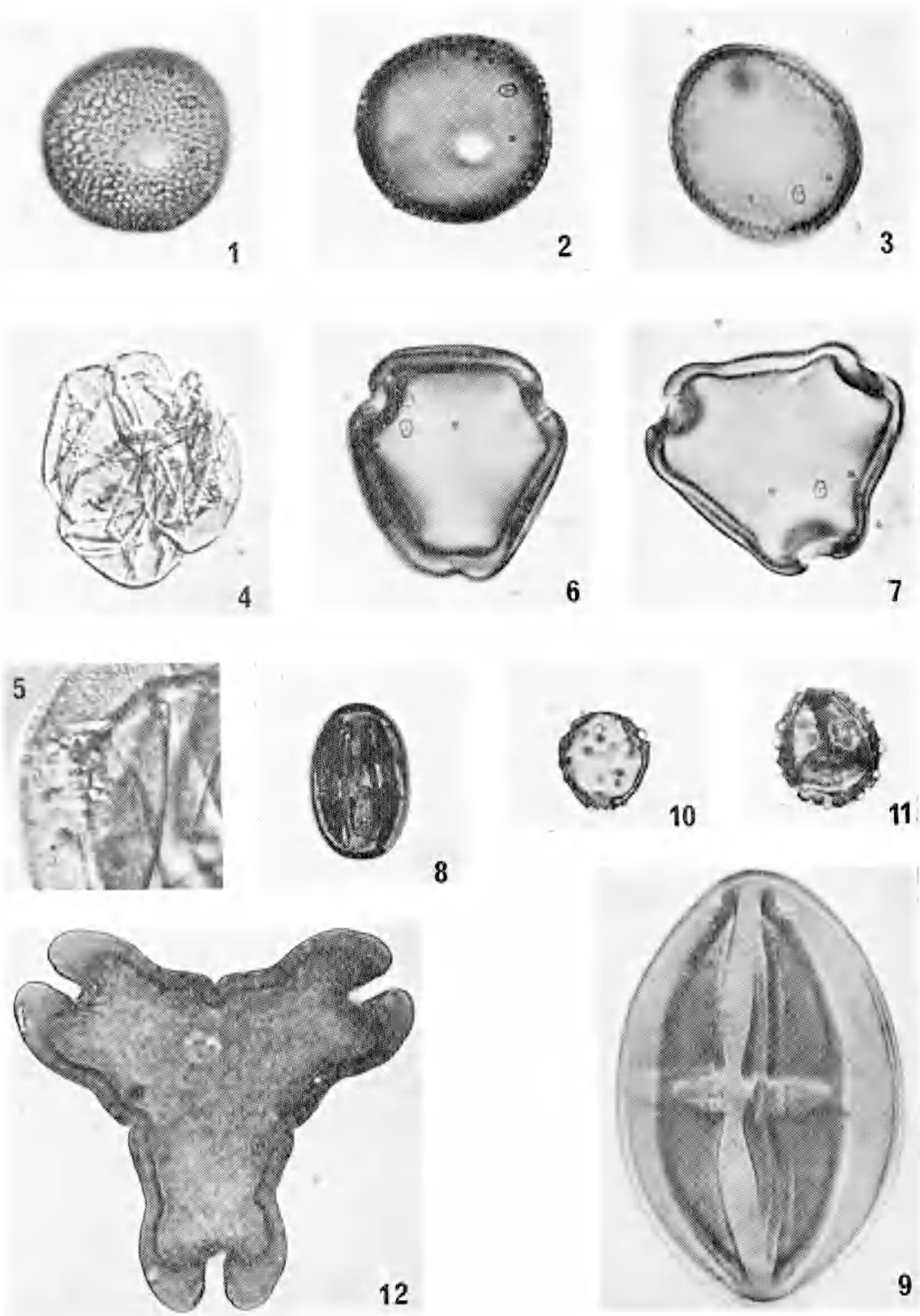
Figs. 38–49

Fig. 38. *Proteacidites fromensis* sp. nov. S1986/2, 27.0: 99.3.

Figs. 39–42. *Proteacidites varius* sp. nov. X 1250. Figs. 39, 40.—S705/1, 37.2: 111.0. High and mid focus respectively. Fig. 41.—S547/1, 22.7: 96.0. Fig. 42.—S705/1, 98.8: 44.3.

Figs. 43–47. *Proteacidites wilkatanaensis* sp. nov. Figs. 43, 44.—S2273/4, 44.1: 106.7. Mid and high focus respectively. Fig. 45.—S705/2, 22.8: 105.9. Figs. 46, 47.—S2273/3, 33.2: 107.1. High and mid focus respectively.

Figs. 48, 49. *Proteacidites concretus* sp. nov. X 1250. Fig. 48.—S360/2, 35.8: 105.5. Fig. 49.—S705/3, 26.9: 105.5.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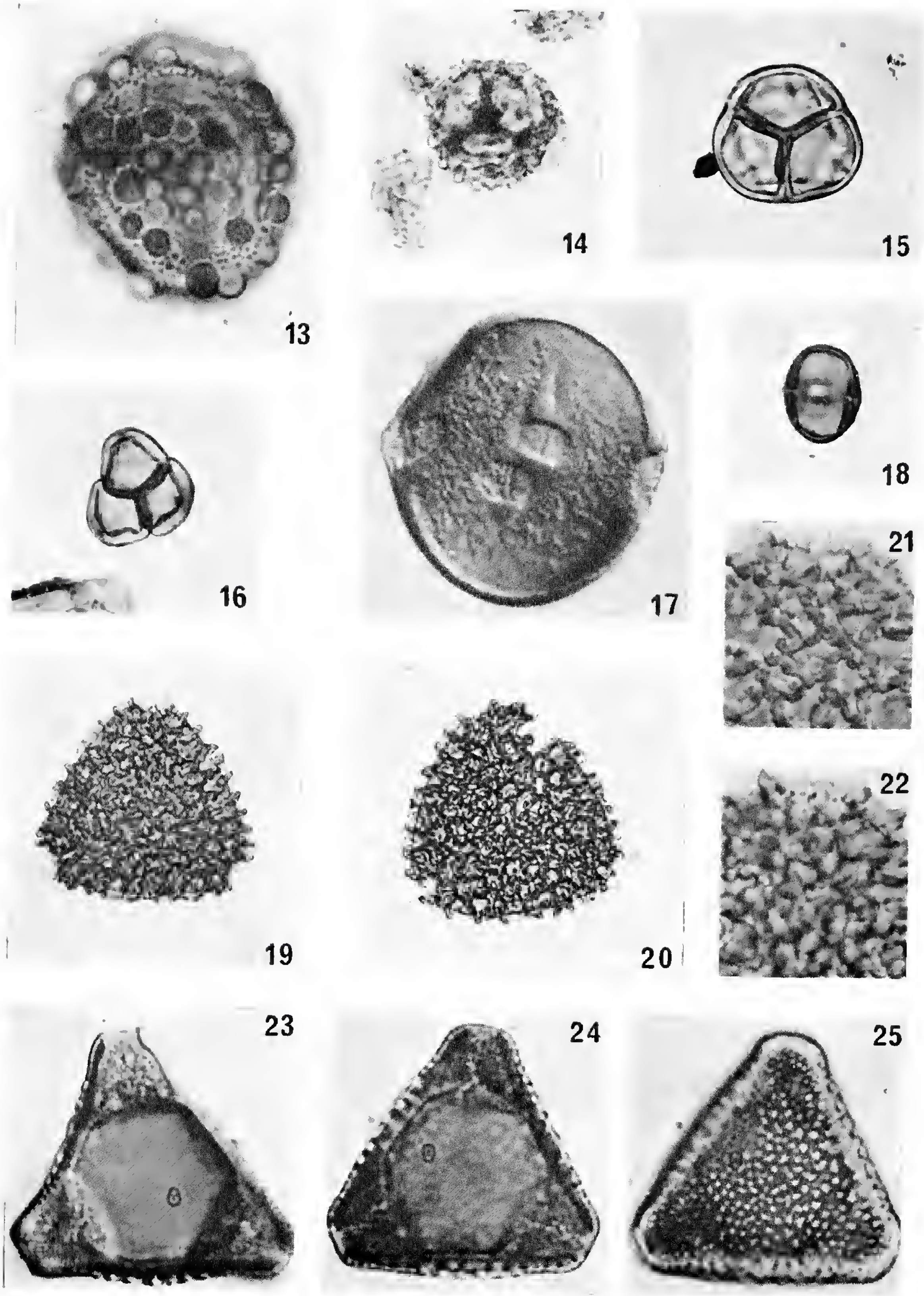
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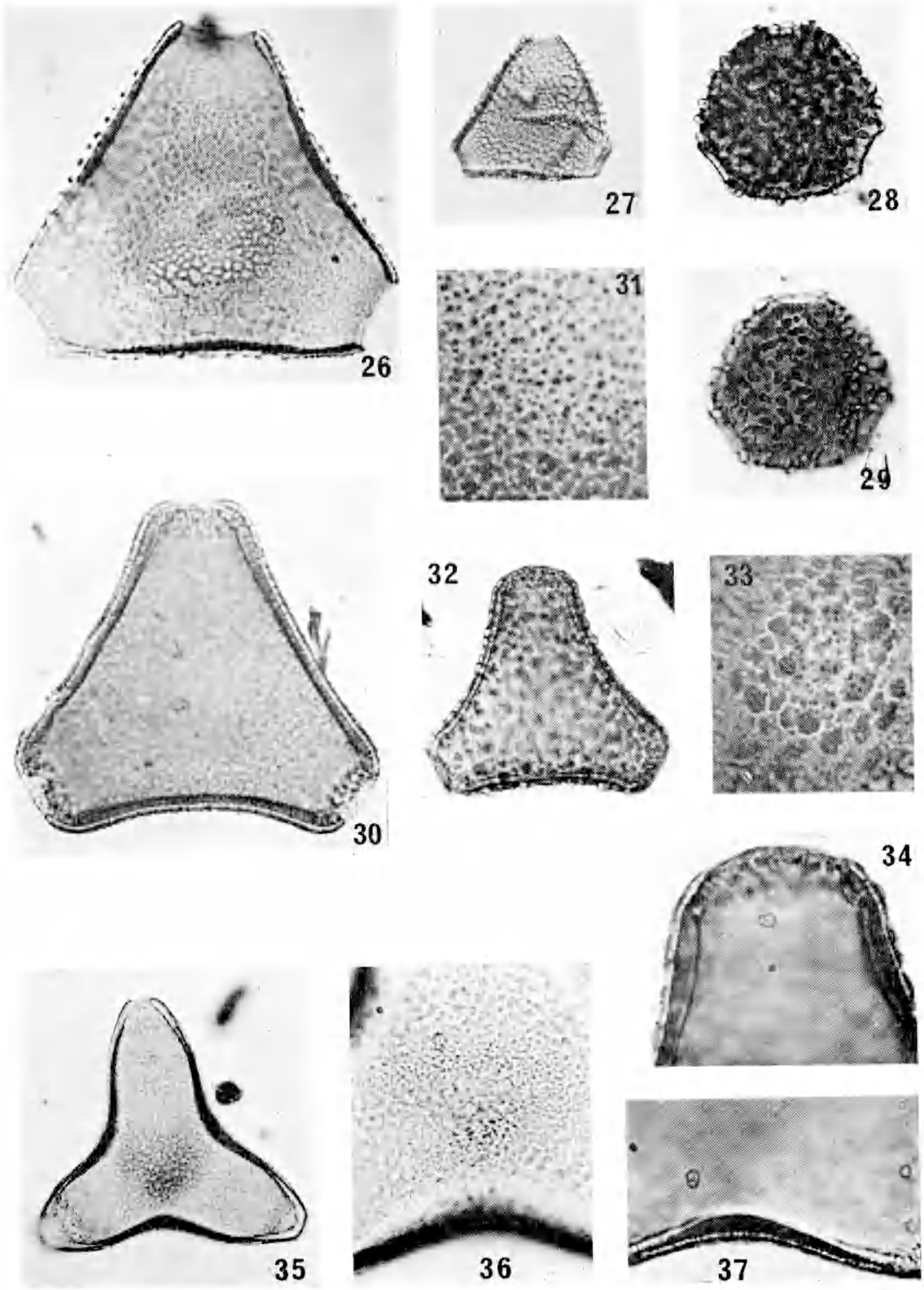
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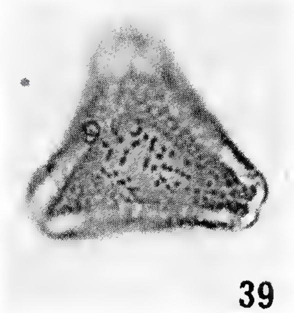
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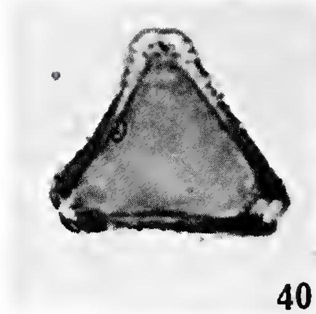
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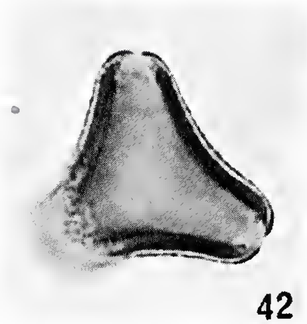
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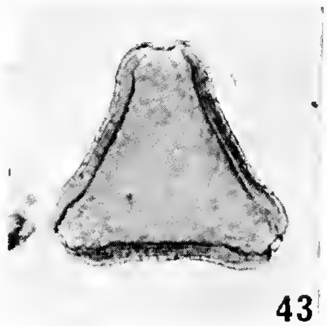
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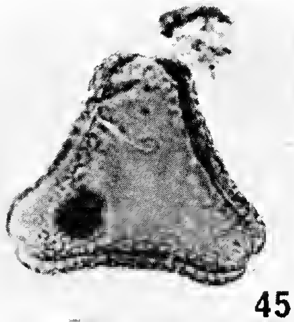
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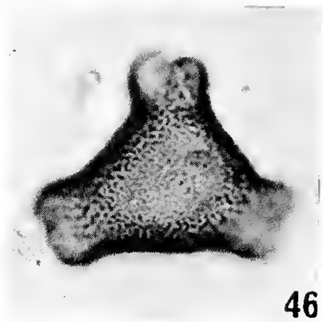
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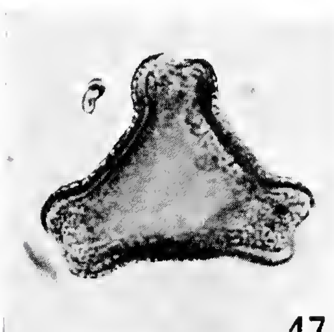
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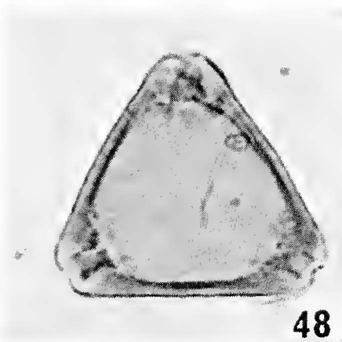
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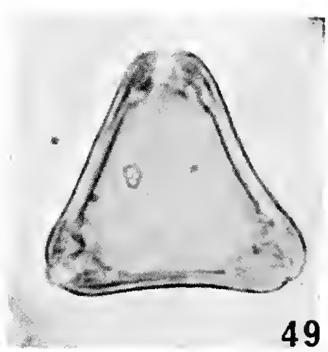
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